RECEIVED
CENTRAL FAX CENTER
JUL 0 2 2007

REMARKS

In the Office Action dated April 6, 2007, claims 1 and 4-9 are pending and all claims are rejected. The rejection is made final. Reconsideration is requested, at least for the reasons discussed herein.

Claims 1, 4-6 and 8 are rejected under 35 U.S.C. §102 over van den Berk (US 4,536,059). The Examiner states that:

> Van den Berk teaches . . . the liquid crystal layer has at least two different values for a first threshold voltage for transitioning the liquid crystal layer from the planar state to the focal conic state (because the electrodes 5 are provided in the grooves and extend over "second ridges" 4 onto "first ridges" 3, hence extend over regions of different thickness ... and consequently the electric field at two positions of different thickness is different).

Applicants strongly disagree. Van den Berk fails to teach or suggest at least that "the liquid crystal layer includes **at least two regions** having **different values of a first threshold voltage** for transitioning the liquid crystal layer from the planar state to the focal conic state," as claimed herein.

Van den Berk merely discloses an invention for transitioning the liquid crystal layer from the focal conic state to a homeotropic state according to the applied voltage, as mentioned, for example, an industrial field of the invention. Further, van den Berk teaches that "the planar-conic texture does not occur in an operating matrix display device' (see column 4, lines 8-12 of van den Berk), which is far different from the present invention.

Nothing in van den Berk teaches a "liquid crystal layer [that] includes at least **two** regions having **different** values of **a first threshold voltage** for transitioning the liquid crystal layer from the planar state to the focal conic state," as claimed herein.

The Examiner points out that the prior art references disclose that a thickness d of the liquid crystal layer has at least two different values and, then concludes erroneously that such different thickness automatically provides two regions having different values of a first threshold voltage for transitioning the liquid crystal layer from the planar state to the focal conic state.

However, the references do not disclose that two regions in the pixel transition at <u>different threshold voltage</u>.

As noted by the Examiner, at col. 3, lines 61-65, van den Berk teaches:

> Upon applying ***a voltage*** across the electrodes the transparent planar-conic texture changes into a light-scattering focal-conic texture, as shown in FIG. 1c, at a field strength dependent on the liquid crystal used.

[Emphasis added.] There is not even a hint of a suggestion in van den Berk that each pixel of the "liquid crystal layer includes at least **two regions** having **different** values of **a first threshold voltage** for transitioning the liquid crystal layer from the planar state to the focal conic state."

Although van den Berk discloses two different LC thicknesses in the pixel, FIG. 1a clearly discloses only one first threshold voltage value. When field strength increase above E2, a transparent homeotropic-nematic texture is formed as shown in FIG. 1d. When the field strength decreases below E_1 (E_1<E_2), the light-scattering focal-conic texture is again formed. Van de Berk provides a structure such that the texture is maintained when the field strength E_H is such that E_1<E_H< E_2 depending on the direction of change of field strength. There is no teaching in van den Berk for each pixel to have two or more regions having different values of a first threshold voltage for transitioning the liquid crystal layer from the planar state to the focal conic state.

At col. 4, lines 11-17, van den Berk teaches:

> ... the planar-conic texture does not occur in an operating matrix display device. At a field strength E_1<E_H<E_2 the liquid crystal layer is in a transparent homeotropic-nematic state when the field strength is initially higher than E_2 or is in a light-scattering focal-conic state when the field strength is initially lower than E_1.

Thus, there is no teaching that each pixel of the "liquid crystal layer includes at least two regions having different values of a first threshold voltage for transitioning the liquid crystal layer from the planar state to the focal conic state," as claimed herein.

Van den Berk discloses a LCD device having two supporting plates wherein the plates have ridges. The ridges divide each picture element into a number of sub-elements and the edges of each sub-element in the homeotropic-nematic texture [of the liquid crystal composition] is maintained above E_2 if a field strength between E_1 and E_2 prevails at the area of the picture element (col. 2, lines 57-61). Above **a threshold value** E_{th} of the field strength, the liquid crystal material is light scattering. Above a field strength E_2, the liquid crystal layer is transparent. As a result of hysteresis, the liquid crystal changes back to light scattering below a field strength E_1. At a field strength between E_1 and E_2, the liquid crystal layer is either in the transparent state or in the light-scattering state depending on whether the field strength started from a value higher than E_2 or a value lower than E_1. (Col. 1, lines 33-52)

Thus, the ridges provided by van den Berk have no effect in providing a LCD device that is capable of performing an intermediate gray level display or a multiple gray level display. In van den Berk, if the field strength for a picture element is above the between the value E_1 and the value E_2, the ridges held above E_2 prevent the surrounding liquid crystal material from growing into a transparent region. (Col. 5, lines 21-29)

This, van den Berk ***fails*** to teach or suggest that:

> in each of the plurality of pixels, a thickness d of the liquid crystal layer has at least two different values, and the liquid crystal layer includes at least two regions ***having different values of a first threshold voltage for transitioning*** the liquid crystal layer from the planar state to the focal conic state,

as claimed herein. Van den Berk discloses only one threshold voltage for the entire liquid crystal layer.

The present invention provides a liquid crystal display device that is capable of performing a multiple gray level display. Van den Berk does not even discuss or recognize the problems in providing gray scale levels. Certainly, nothing in van den Berk solves such problems, which are solved by the present invention.

The Examiner states that the limitation "whereby the liquid crystal display device that is capable of performing an intermediate gray level display or a multiple gray level display" is a statement of intended use and functional language must result in a structural difference to patentably distinguish from the prior art.

It is respectfully submitted that the claim language

> in each of the plurality of pixels, a thickness d of the liquid crystal layer has at least two different values, <u>and the liquid crystal layer includes at least two regions</u> <u>***having different values of a first threshold voltage for transitioning***</u> the liquid crystal layer <u>from the planar state to the focal conic state</u>,

as claimed herein, is a structural distinction over the cited prior art. The whereby clause adds to this structural distinction by clarifying that gray levels are provided. The structure of van den Berk does not provide gray level and does not provide a "liquid crystal layer [that] includes at least two regions having different values of a first threshold voltage for transitioning the liquid crystal layer from the planar state to the focal conic state," as claimed herein.

In the Response to Arguments, the Examiner appears to believe that Applicant's traversal is based on an argument that van den Berk merely is operated in a different manner from the present invention. Applicant submits that the structure of van den Berk does not provide in each of the plurality of pixels, a thickness d of the liquid crystal layer has at least two different values, <u>and the liquid crystal layer includes at least two regions</u> <u>***having different values of a first threshold voltage for transitioning***</u> the liquid crystal layer <u>from the planar state to the focal conic state</u>, as is provided by the present invention. In van den Berk, each entire pixel has only one first threshold voltage for transitioning the liquid crystal layer from the planar state to the focal conic state. Thus, the presently claimed structure is substantially different from that of van den Berk. The structure provided by van den Berk, unlike the present invention, has no effect in providing a LCD device that is capable of performing an intermediate gray level display or a multiple gray level display.

Claim 7 is rejected under 35 U.S.C. §103(a) over van den Berk in view of Scherer (US 5,880,801). Van den Berk is discussed in detail above. Scherer *fails* to make up for the

deficiencies in van den Berk. Schere also fails teach or suggest that in each of the plurality of pixels, a thickness d of the liquid crystal layer has at least two different values, **and the liquid crystal layer includes at least two regions *having different values of a first threshold voltage*** for transitioning the liquid crystal layer from the planar state to the focal conic state.

Thus, it is not seen how the present invention would have been obvious to one of ordinary skill in the art in view of any combination of van den Berk and Scherer.

Claims 1, 8 and 9 are rejected under 35 U.S.C. §103(a) over Yamada et al. (US 5,831,704; "Yamada") in view of Nakamura et al. (US 5,576,860: "Nakamura"). Neither Yamada nor Nakamura, nor their combination teach or suggest a liquid crystal display device wherein, in each pixel, **the liquid crystal layer includes at least two regions *having different values of a first threshold voltage*** for transitioning the liquid crystal layer from the planar state to the focal conic state, as claimed herein. Although Yamada illustrates a device wherein the liquid crystal material thickness changes in height, there is no teaching for constructing the LCD to have **at least two regions *having different values of a first threshold voltage*** for transitioning the liquid crystal layer from the planar state to the focal conic state. Thus, at no voltage, the Yamada LCD is in the planar state. At saturation voltage, the Yamada LCD is in the focal conic state. The saturation voltage is the only threshhold voltage in Yamada for transitioning the liquid crystal layer from the planar state to the focal conic state, and it applies to the entire pixel region. There is no second region in the pixel of Yamada having a different first threshold voltage.

Thus, Yamada discloses a very different method for accomplishing gray scale than used in the present invention. In Yamada, the liquid crystals align at an angle at intermediate voltage between black (light-scattering) and white (transparent), thereby providing a gray scale. In the present invention, the region having a lower first threshhold voltage will transition completely from the planar state to the focal conic state while the second region having a higher first threshhold voltage remains unchanged. Thus, the present invention accomplishes gray scale by controlling the portion of the pixel that is transitioned from the planar state to the focal conic state at a particular applied voltage.

The Examiner states that it is the electric field that controls the molecular orientation of the liquid crystals form the planar state to the focal conic state. Nevertheless, there is no teaching or suggestion, whatsoever, in Yamada to have in each pixel at least two regions wherein the first threshold voltage has different values in at least two regions for transitioning the liquid crystal layer from the planar state to the focal conic state. In Yamada, the transition from planar state to focal conic state occurs at the saturation voltage for the entire pixel.

Nakamura fails to make up for the deficiencies of Yamada. Nakamura also fails to teach or suggest constructing the LCD to have **at least two regions** ***having different values of a first threshold voltage*** for transitioning the liquid crystal layer from the planar state to the focal conic state.

Thus, it is not seen how the present invention would have been obvious to one of ordinary skill in the art in view of any combination of Yamada and Nakamura.

Claim 4 is rejected under 35 U.S.C. §103(a) over Yamada in view of Nakamura, and further in view of Ogawa et al (US 4,632,514; "Ogawa"). Yamada and Nakamura are discussed above. Ogawa fails to make up for the deficiencies of Yamada and Nakamura. Ogawa also fails to teach or suggest constructing the LCD to have **at least two regions** ***having different values of a first threshold voltage*** for transitioning the liquid crystal layer from the planar state to the focal conic state.

Thus, it is not seen how the present invention would have been obvious to one of ordinary skill in the art in view of any combination of Yamada, Nakamura and Ogawa.

In view of the above amendment, applicant believes the pending application is in condition for allowance.

Dated: July 2, 2007

Respectfully submitted,

By ______________________
George W. Neuner
Registration No.: 26,964
EDWARDS ANGELL PALMER & DODGE LLP
P.O. Box 55874
Boston, Massachusetts 02205
(617) 517-5538
Attorneys/Agents For Applicant

BOS2_605073.1